

## When Antibiotics Fail

### Steps 1-9 Data Table -

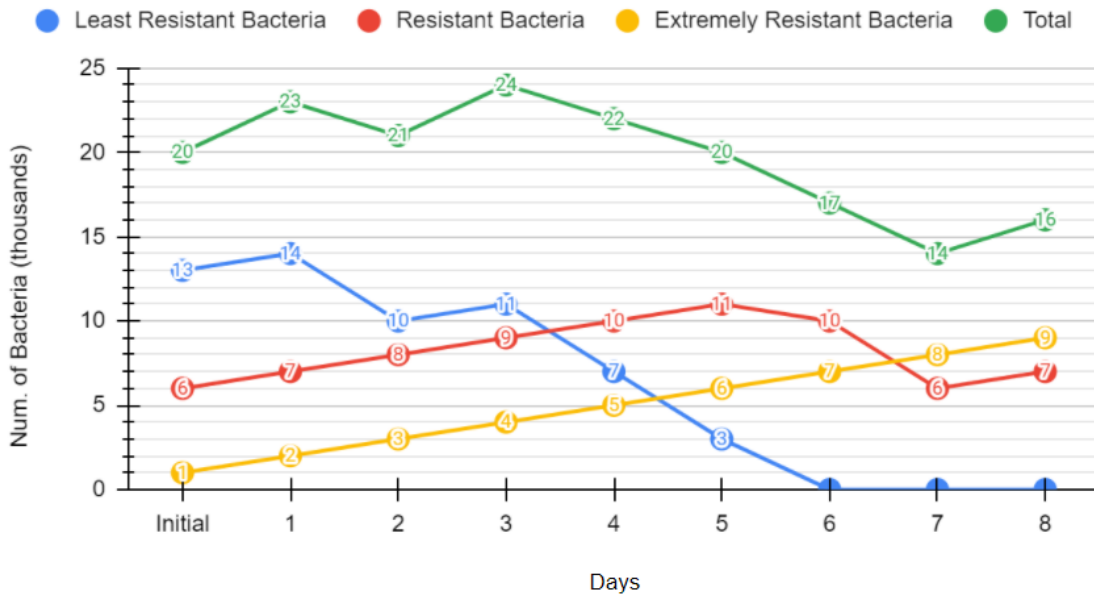
### Number of Pneumococcal Bacteria in Your Body

Antibiotics... Taken: 1, 3, 5, 6    Not Taken: 2, 4

Day	Least Resistant Bacteria	Resistant Bacteria	Extremely Resistant Bacteria	Total
<b>Initial</b>	13	6	1	20
<b>1</b>	14	7	2	23
<b>2</b>	10	8	3	21
<b>3</b>	11	9	4	24
<b>4</b>	7	10	5	22
<b>5</b>	3	11	6	20
<b>6</b>	0	10	7	17
<b>7</b>	0	6	8	14
<b>8</b>	0	7	9	16

## Step 11

### Bacterial Growth During Inconsistent Antibiotic Use



## Step 12 Class Summary -

The class results cover a range from 0 surviving bacteria to 16 surviving bacteria. Most individuals did not properly execute the experiment, as they did not account for bacterial multiplication when the antibiotic was not taken. Furthermore, several peers' data is unclear; Tasrina's data has an unexplained increase in least resistant bacteria from round 3 to 4. The only students to account for the bacterial multiplication when no antibiotic was taken were Roshan and Roshith, and myself. Tanneil's data shows the best result of taking antibiotics as prescribed. My results show the worst use of antibiotics as the most bacteria are present at the end of the prescription. All in all, the results are not consistent as nearly all students failed to account for bacterial multiplication when no antibiotic was used, and many students executed the subtraction improperly (error when carrying over the subtraction from low resistance to high resistance bacteria, or failure to add one back for each surviving colony).

Class Results After 8 Rolls:

Nora and Ava	= =	9
Daniel (Me)	= =	16
Lorenzo	= =	6

Mahi	= =	9
Roshan and Roshith	= =	13
Xaritzzy	= =	10
Niya	= =	2
Tanneil	= =	0
Tasrina	= =	3

### **Conclusion Questions -**

***How did your results compare to the results of others? Explain why others obtained different results.***

My results were the highest in the class. Others obtained different results because they executed the trials unlike the procedure described. Most students failed to add one bacteria when antibiotics were not taken, leading them to have lower numbers (exacerbated as thresholds for different resistances lead to less reproduction overall). Others also obtained different results because the numbers rolled on their dice were different. For instance, Tanneil rolled numbers that involved taking antibiotics for six consecutive days. This led to her final tally of 0 bacteria. My trials, resulting in 16 bacteria, included 4 rolls of antibiotics and 4 rolls of no antibiotics. In short, others obtained different results based on their following of the procedure and the numbers which they rolled.

***Given what you know about antibiotics, what other variables, besides missing doses, might affect the effectiveness of an antibiotic?***

The effectiveness of an antibiotic may also be impacted by the temperature at which it is stored. If the antibiotic is stored at a temperature above or below the described range, its quality will deteriorate. Similarly, antibiotics may decline in effectiveness if they are left open and become contaminated. Lastly, the effectiveness of an antibiotic is impacted by the dosage. If improper doses are taken or administered, the patient may have serious side effects or the antibiotic dose may be insufficient.

***Sue Smith wants to know why she has to continue taking her antibiotics even though she is feeling better. Explain the importance of Sue completing her full course of antibiotics as prescribed.***

You need to continue taking your antibiotics, even though you are feeling better, in order for you to stay better. You feel better because the majority of bacteria are now dead. These bacteria were responsible for your bacterial meningitis and were the least resistant. The strongest, most resistant bacteria are still leftover as the bacteria roots out the bacteria with the lowest resistance first. Taking your antibiotics, even though you no longer have symptoms ensures that the strongest bacteria are killed. If you do not take the antibiotics, the remaining bacteria will grow exponentially and you will likely be infected again. Therefore, it is critical that you continue taking your antibiotics as prescribed, which will stop being administered when the most resistant bacteria are presumed dead.

***Patients forgetting to take their antibiotics are not the sole cause of antibiotic resistance.***

***Explain at least two other possible causes of the development of antibiotic-resistant bacteria.***

Antibiotic-resistant bacteria can develop from a variety of habits or actions. Overuse of antibiotics in farms and agriculture can lead to species developing bacteria resistant to the used antibiotic. As a result, when people take the same antibiotic, it is ineffective as the bacteria has mutated for survival. Since bacteria become resistant on their own, “survival of the fittest,” new antibiotics need to be constantly developed. If this process is not carried out, then bacteria can rapidly multiply with no halting force. Opposite to not taking antibiotics, taking too much of an antibiotic can build antibiotic resistance. Since the bacteria are exposed to a stronger dose, they mutate to be even more resistant. As a result, the next time the antibiotic is used, an even larger dose is needed (similar to patients that become addicted to painkillers). Lastly, poor hygiene and lack of responsibility could stimulate the formation of antibiotic-resistant bacteria. Poor hygiene can spread the bacteria to other individuals and give the bacteria an ideal, nutrient-rich environment to feed off.